UNIT TEST-01

Subject : Physics
Class : XII

Q.1 (1)	**Q.2** (1)	**Q.3** (4)	**Q.4** (4)	**Q.5** (1)	**Q.6** (3)	**Q.7** (3)	**Q.8** (4)	**Q.9** (3)	**Q.10** (1)
Q.11 (3)	**Q.12** (1)	**Q.13** (3)	**Q.14** (1)	**Q.15** (3)	**Q.16** (4)	**Q.17** (2)	**Q.18** (1)	**Q.19** (3)	**Q.20** (2)
Q.21 (1)	**Q.22** (1)	**Q.23** (2)	**Q.24** (2)	**Q.25** (1)	**Q.26** (3)	**Q.27** (4)	**Q.28** (1)	**Q.29** (2)	**Q.30** (4)
Q.31 (3)	**Q.32** (4)	**Q.33** (4)	**Q.34** (1)	**Q.35** (3)	**Q.36** (2)	**Q.37** (2)	**Q.38** (2)	**Q.39** (1)	**Q.40** (3)
Q.41 (2)	**Q.42** (3)	**Q.43** (1)	**Q.44** (1)	**Q.45** (2)	**Q.46** (2)	**Q.47** (3)	**Q.48** (1)	**Q.49** (1)	**Q.50** (2)

Q.1 (1)

Q.2 (1)

$$9 = \frac{Kq_1q_2}{d^2}$$

$$F = \frac{Kq_1q_2}{9d^2}$$

$$\Rightarrow F = \frac{9}{9} = 1N$$

Option (1)

Q.3 (4)
If two charged balls are joined by wire and then removed, then charge equally distributed on both.

So, finally, $q_1 = \frac{Q}{2}$ and $q_2 = \frac{Q}{2}$

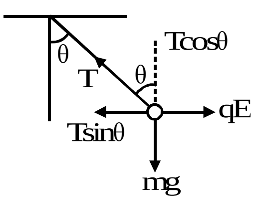
So, $F \propto q_1q_2$

So, $F_{finally} \propto \frac{Q}{2} \times \frac{Q}{2}$

$F_{initially} \propto (Q)(2Q)$

$$\Rightarrow \frac{F_{finally}}{F_{initially}} = \frac{1}{8} \Rightarrow F_{finally} = \frac{F}{8}$$

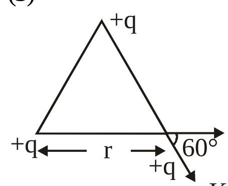
Q.4 (4)



Tcosθ = mg
Tsinθ - qE

Q.5 (1)
Both charge should be unlike charge
$q_1 = Q_1$, $q_2 = -Q_2$
So $q_1q_2 = -Q_1Q_2$
So q_1q_2 = Negative
So $q_1q_2 < 0$

Q.6 (3)



$$\frac{Kqq}{r^2} = F$$

$$\frac{Kqq}{r^2} = F$$

$$R = \sqrt{F^2 + F^2 + 2FF\cos 60°}$$

$$R = \sqrt{3}F = \frac{\sqrt{3}kq^2}{r^2}$$

Q.7 (3)

q_1 q_2 $f_1 = 100 = \frac{Kq_1q_2}{r^2}$

$q_1 \to 1.1q_1$ $q_2 = 0.9q_2$

$$f_2 = \frac{K(1.1q_1)(0.9q_2)}{r^2} = 1.1 \times 0.9 \times 100 = 99N$$

Q.8 (4)
Let, net electric field is zero at point P. So at point P

$$|\vec{E}_1| = |\vec{E}_2|$$

$$\Rightarrow \frac{k.4q}{x^2} = \frac{k \cdot 9q}{(r+x)^2}$$

$$\Rightarrow \frac{r+x}{x} = \frac{3}{2}$$

$\Rightarrow 2r + 2x = 3x$
$\Rightarrow x = 2r$

Q.9 (3)
Inside the sphere

$$E' = \frac{kQr}{R^3} = \frac{kQ \times 3 \times 10^{-2}}{(10 \times 10^{-2})^3}$$

Outside the sphere

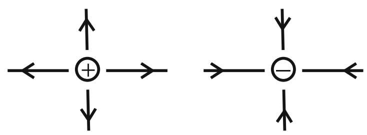
$$E = \frac{kQ}{(20\times10^{-2})^2}$$

$$\Rightarrow E' = \frac{E\times(20\times10^{-2})^2\times3\times10^{-2}}{(10\times10^{-2})^3}$$

$$= \frac{100\times400\times3}{1000}$$

$E' = 120$ V/m

Q.10 (1)



Q.11 (3)

$v^2 = u^2 + 2as$

$$v^2 = 2\left[\frac{qE}{m}\right].y$$

Now $KE = \frac{1}{2}mv^2 = qEy$

Q.12 (1)

Q.13 (3)

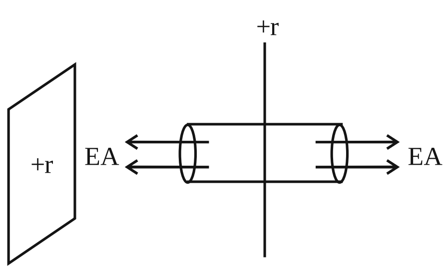
$$E_{out} = \frac{KQ}{r^2}$$

$$100 = \frac{KQ}{(0.2)^2} \text{ ....(i)}$$

or KQ = 100 (0.04) = 4

$$E_{in} = \frac{KQr}{R^3} = \frac{4(0.03)}{(0.1)^3} = 120$$

Q.14 (1)



From Gauss law :

$$2EA = \frac{\sigma A}{\epsilon_0} \Rightarrow E = \frac{\sigma}{2\epsilon_0}$$

Q.15 (3)

$$Q_{eachface} = \frac{Q_{cube}}{6} = \frac{q}{6\varepsilon_0}$$

Q.16 (4)

Inward flux is taken as negative while outward flux is taken as positive.

$\Rightarrow$ total flux = $4 \times 10^3 - 8 \times 10^3 = -4 \times 10^{+3}$

$$\Rightarrow \frac{q_{in}}{\varepsilon_0} = -4 \times 10^{+3} \Rightarrow q_{in} = (-4\,\varepsilon_0 \times 10^3)C$$

Q.17 (2)

According to Gauss's law,

Electric flux, $\phi = \frac{q}{\varepsilon_0}$

where q = total charge enclosed by closed surface

$$\therefore \phi = \frac{1.25+7+1-0.4}{\varepsilon_0} = \frac{8.85C}{8.85\times10^{-12}C^2\,N^{-1}m^{-2}}$$

$= 10^{12}$ N m2 C^{-1}

Q.18 (1)

W = QV

$$\therefore V = \frac{W}{Q} = \frac{2}{20} = 0.1 \text{ volt}$$

Q.19 (3)

$\Delta V_{max} = Er = 10 \times 3 = 30$ volt

$\Delta V = Er\cos\theta = 25$ volt

Q.20 (2)

$$E_{axis} = \frac{2kP}{r^3}$$

$$E_{eq.} = \frac{kP}{r^3}$$

Q.21 (1)

$U = -\vec{P}.\vec{E} = -PE\cos\theta$

At $\theta = \pi$

$U = -PE\cos\pi = -PE \times -1$

$= +PE$

Q.22 (1)

With change in shape of conductor its capacitance changes

$\therefore$ potential changes

as $V = \frac{Q}{C}$

Q.23 (2)

field just outside the conductor is

$$E = \frac{\sigma}{\varepsilon_0} \quad \text{so}$$

$$E_A = E_B = \frac{\sigma}{\varepsilon_0}$$

Q.24 (2)

Energy density is $u = \frac{1}{2}\varepsilon_0 E^2$

$$E^2 = \frac{2u}{\varepsilon_0}$$

$$E^2 = \frac{2 \times 2.1 \times 10^{-9}}{8.85 \times 10^{-12}} = 4.74 \times 10^2$$

$E = 21.6$ N/C

Q.25 (1)

Q.26 (3)

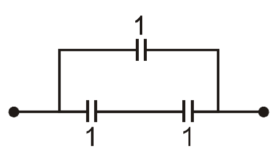
$C = 4\pi\varepsilon_0 R$ and $V = \frac{4}{3}\pi R^3$

$A = 4\pi R^2$

$$R = \left(\frac{3V}{A}\right)$$

$$\therefore C = 12\pi\varepsilon_0 \left(\frac{V}{A}\right)$$

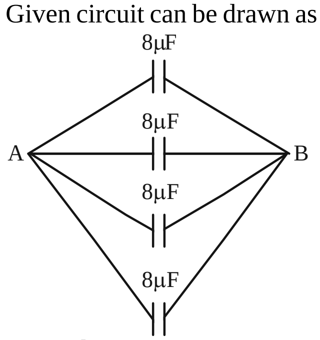
Q.27 (4)



$C_{net} = 1.5\ \mu F$

Q.28 (1)

Given circuit can be drawn as



Equivalent capacitance = 4 × 8 = 32 μF.

Q.29 (2)

Q.30 (4)

$(V_B - V_A) \times 2\mu + (V_B - V_A) \times 3\mu = 0$

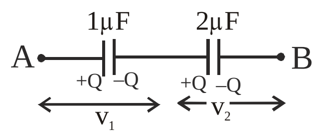
$(V_B - 1000) \times 2 + (V_B - 0) \times 3 = 0$

$2V_B - 2000 + 3V_B = 0$

$5V_B = 2000$

$V_B = 400$ volt

Q.31 (3)



$(Q)_{1\mu F} = (Q)_{2\mu F}$

$1 \times v_1 = 2v_2$ ...(1)

$v_1 + v_2 = 120$ ....(2)

From Eq (1) and (2)

$v_1 = 80$ volts

$v_2 = 40$ volts

Q.32 (4)

In this case, the work done is stored as electrostatic potential energy in the capacitor.

$$W = \frac{1}{2}CV^2 = \frac{1}{2}\frac{q^2}{C}$$

$$= \frac{1}{2} \times \frac{(8 \times 10^{-18})^2}{100 \times 10^{-6}}$$

$$= \frac{1}{2} \times \frac{64 \times 10^{-36}}{100 \times 10^{-6}} = 32 \times 10^{-32}\ J$$

Q.33 (4)

Given that,

$C = 500\mu F$

$$\frac{dq}{dt} = 100\ \mu C s^{-1}$$

$V = 10$ volt

Then the total charge on the capacitor

$q = CV$

$= 500 \times 10^{-6} \times 10$

$= 5 \times 10^{-3} C$

Hence, time = $\frac{\text{total charge}}{\text{charge rate}}$

$$E = \frac{5 \times 10^{-3} C}{100 \times 10^{-6} C} s$$

= 50s

Q.34 (1)

$$U = \frac{Q^2}{2C} \because C \uparrow U \downarrow$$

Q.35 (3)

Heat produced in the resistance

H = Energy of the condenser $= \frac{1}{2}CV^2$

where, C = capacitance of the condenser
$= 2\mu F = 2 \times 10^{-6} F$
V = potential difference between the plates of the condenser = 500 V

$$\therefore\ H = \frac{1}{2} \times 2 \times 10^{-6} \times (500)^2$$

$= 1 \times 10^{-6} \times 25 \times 10^4$
$= 0.25\ J$

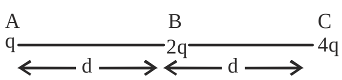
Q.36 (2)

$$F = \frac{1}{4\pi \epsilon_0}\frac{q_1 q_2}{r^2}$$

$$\epsilon_0 = \frac{q_1 q_2}{4\pi F r^2}$$

Unit of ϵ_0 is $C^2/N\text{-}m^2$

Q.37 (2)

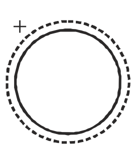


$$F_A = \frac{k(q)(2q)}{d^2} + \frac{k(4q)(q)}{(2d)^2}; F_A = \frac{3kq^2}{d^2}$$

$$F_C = \frac{k(4q)(q)}{(2d)^2} + \frac{k(4q)(q)}{d^2}$$

$$F_C = \frac{9kq^2}{d^2}, \qquad \frac{F_A}{F_C} = \frac{T_{AB}}{T_{BC}} = \frac{1}{3} \Rightarrow 1:3$$

Q.38 (2)



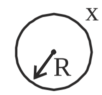
Due to repulsive force between charge its radius increases.

Q.39 (1)

Surface charge density ,$\sigma = \frac{\text{Charge}}{\text{area}}$

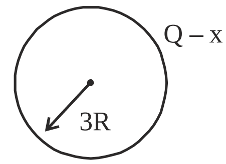
As $\sigma_1 = \sigma_2$

$$\frac{x}{4\pi R^2} = \frac{Q - x}{4\pi(3R)^2}$$



$$\Rightarrow \frac{x}{R^2} = \frac{Q-x}{9R^2}$$

$$\Rightarrow ƨ = \frac{Q-x}{9}$$

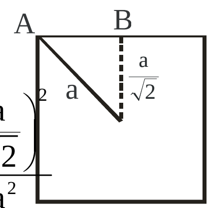


$\Rightarrow 9x = Q - x \Rightarrow 10x = Q$

$\Rightarrow x = \frac{Q}{10}$ = Charge on smaller one

Q.40 (3)

$$E \propto \frac{1}{r^2}$$



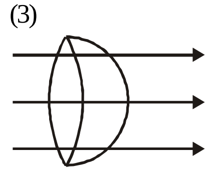
$$\frac{E_A}{E_B} = \frac{\left(\frac{a}{\sqrt{2}}\right)^2}{a^2}$$

$$\Rightarrow \frac{E_A}{E_B} = \frac{1}{2}$$

Q.41 (2)

$$\text{Flux} = \frac{1}{6}\frac{q}{\epsilon_0} \times \frac{4\pi}{4\pi} = \frac{4\pi q}{6(4\pi t_0)}$$

Q.42 (3)



$\phi_{total} = 0$
$\phi_{circular} + \phi_{hemi} = 0$
$\phi_{hemi} = -\phi_{circular}$
$= -[EA \cos 180°] = -E(\pi R^2)(-1)$

$$\boxed{\phi_{hemi} = \pi R^2 E}$$

Q.43 (1)

$$\varphi = \frac{q_{in}}{\varepsilon_0}$$

Now $\varphi' = \frac{q_{in}}{2\varepsilon_0} = \frac{\varphi}{2}$

Q.44 (1)

$$v = \frac{kq}{r} = 10v$$

$$27 \times \frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3$$

$R = 3r$

$$v' = \frac{k \times 27q}{3r} = 90 \text{ volt}$$

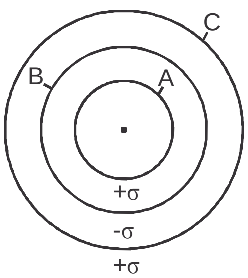
Q.45 (2)

$$V = \frac{K.P\cos\theta}{r^2} = V = \frac{90\times10^9 \times 2\times10^{-8}\times\frac{1}{2}}{(3)^2}$$

= 10 volt

Q.46 (2)

Potential on B = potential on A due to charge + potential on B due to charge +potential on C due to charge



$$\therefore\ V_B = \frac{k(Q_A + Q_B)}{b} + \frac{kQ_c}{c}$$

$$= \frac{1}{4\pi\varepsilon_0}\left[\frac{\sigma 4\pi a^2}{b} - \frac{\sigma 4\pi b^2}{b} + \frac{\sigma 4\pi c^2}{c}\right]$$

$$= \frac{\sigma}{\varepsilon_0}\left(\frac{a^2 - b^2}{b} + \frac{c^2}{c}\right)$$

$$= \frac{\sigma}{\varepsilon_0}\left(\frac{a^2 - b^2}{b} + c\right)$$

$$V_B = \frac{\sigma}{\varepsilon_0}\left(\frac{a^2 - b^2}{b} + c\right)$$

Q.47 (3)

Q-same

$$U' \propto \frac{1}{C}$$

$C' = KC$

$$U' = \frac{C}{C'}U_0 = \frac{U_0}{K}$$

Q.48 (1)

Net potential = 6 – 1 = 5V

Potential on 2μF capacitor

$$V_2 = \frac{3}{3+2}.5 = 3V$$

Charge on capacitor q = CV = 2 × 3 = 6μF

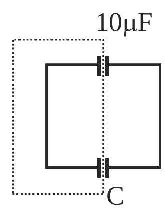
Q.49 (1)

Charge appeared 10μF capacitor = 1000μc.

After connection.

(10μF × 40) (CμF × 40)

= 1000μc



$400 + 40c = 1000$

$40C = 600 \Rightarrow \boxed{C = 15\mu F}$

Q.50 (2)

$$V_{common} = \frac{q_1 + q_2}{C_1 + C_2} = \frac{CV + KC\times 0}{C + KC}$$

$$= \frac{V}{K+1}$$